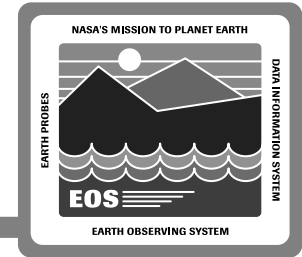


Maintenance and Operations

Stan Dunn

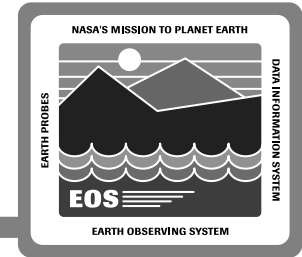
System Design Review - 29 June 1994

Introduction



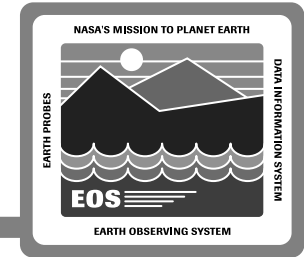
- **Purpose**
 - **Show how ECS architecture provides functionality required by M&O**
 - **Describe M&O functions and staff**
- **Approach**
 - **Define M&O staff based upon new architecture**
 - **Trace staff to architecture subsystems**
 - **Describe staffs' responsibility**

M&O Functionality



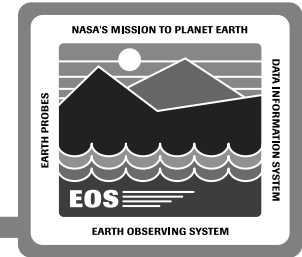
- The functions and staff are independent of who performs them (DAAC personnel, ECS personnel or Government personnel)
- The size of a DAAC does not effect functionality
 - Large DAACs have multiple people doing one function
 - Small DAACs have one person doing multiple functions
- M&O staffing is being re-evaluated to estimate the impact of the modified product distribution, hours of operation trades, and effect of modifying DAAC implementation
- Instilling as much automation into system as practical is being pursued with the goal of as lean an M&O staff as practical

What is Operations?



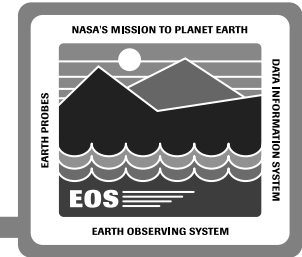
- **On-Line Operations** is the staff of M&O that is actively involved in an operation that leads to an action that produces a product or a command
- **Off-Line Operations** is the staff of M&O that supports the on-line activities but is not directly involved in that action

Maintaining & Operating EOC (Human Intervention)



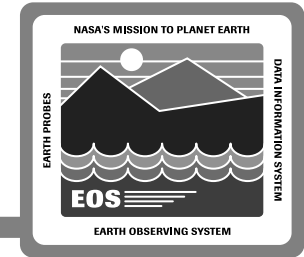
- **On-Line Flight Operational Functions**
 - **Operations Control**
 - **Command Control**
 - **Operations Scheduling**
 - **Telemetry Monitoring**
 - **Ground Control**

Maintaining & Operating EOC (Human Intervention)



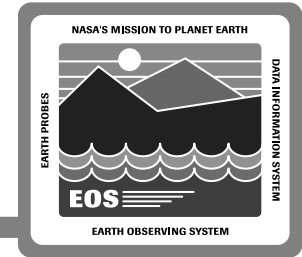
- **Off-Line Flight Operational Functions**
 - **Data Base Maintenance**
 - **Off-Line Analysis**
 - **Mission Planning**
 - **Computer Operation**
 - **Sustaining Engineering**
 - **Software (COTS and developed) Maintenance and Testing**
 - **Hardware Maintenance**
 - **Configuration Management**
 - **Operational Readiness and Performance Assurance**

Maintaining & Operating ECS Science Operations @ DAAC



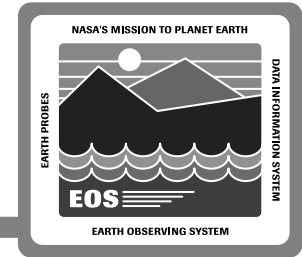
- **On-Line Science Operational Functions**
 - **Data Ingest**
 - **Processing**
 - **Data Storage and Distribution**
 - **Information Access**
 - **Ground Control**

Maintaining & Operating ECS Science Operations @ DAAC



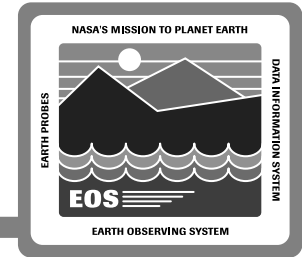
- **Off-Line Science Operational Functions**
 - **Algorithm Integration and Test**
 - **Production Planning & Management**
 - **Data Server Maintenance**
 - **Schema / Data Dictionary Management**
 - **Data Base Administration**
 - **Computer Operation**
 - **Sustaining Engineering**
 - **Software (COTS and developed) Maintenance and Testing**
 - **Hardware Maintenance**
 - **Configuration Management**
 - **Operational Readiness and Performance Assurance**

Maintaining & Operating ECS System Monitoring



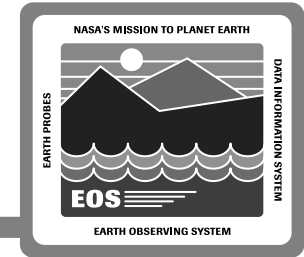
- **On-Line System Monitoring Operational Functions**
 - **WAN Configuration Monitoring**
 - **System Connectivity User Support**
 - **System Fault Management**
 - **System Security Monitoring**

Maintaining & Operating ECS System Monitoring



- **Off-Line System Monitoring Operational Functions**
 - **Ground System Coordination**
 - **System Security Evaluation**
 - **System Analysis**
 - **Network Analysis**
 - **System Configuration Baseline Maintenance**
 - **Accounting and Billing**
 - **Data Base Administration**
 - **Computer Operation**
 - **Sustaining Engineering**
 - **Software (COTS and developed) Maintenance and Testing**
 - **Hardware Maintenance**
 - **Configuration Management**
 - **Operational Readiness and Performance Assurance**

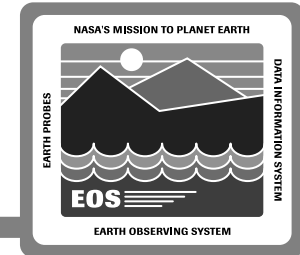
Maintaining & Operating ECS



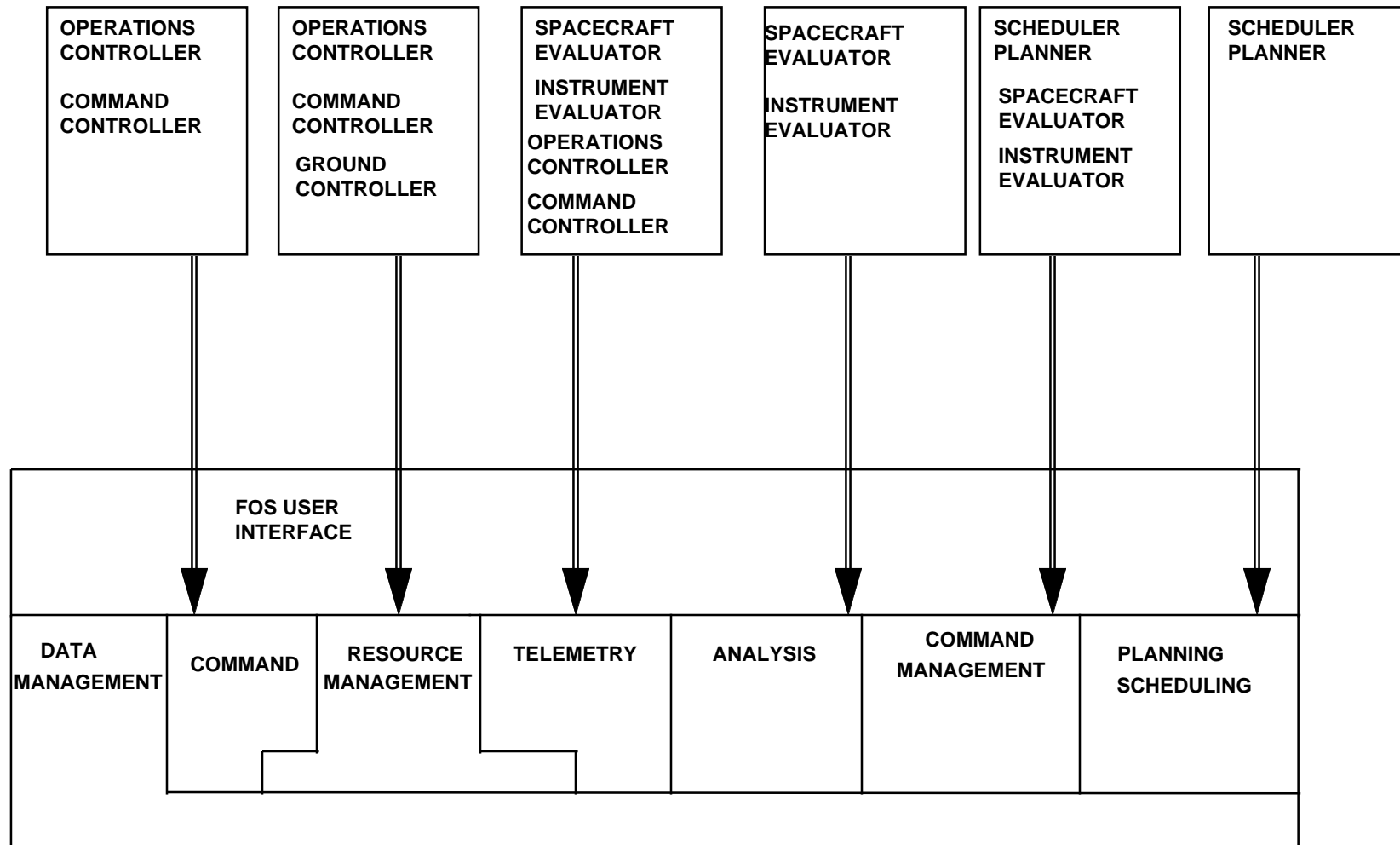
The following System Administration functions are required at every site:

- **Logistics**
- **Personnel Administration**
- **Libraries**
- **Training**
- **Quality Assurance**
- **Property Management**

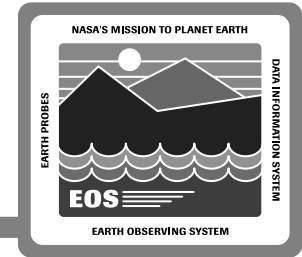
EOC Staff On-Line



EOC STAFF



EOC Operations On-Line

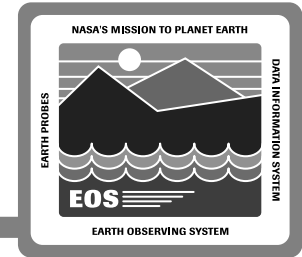


Operations Control

The “Operations Controller” will use the Command, Telemetry, and Resource Management subsystems to:

- Manage EOC hardware resources available for Command and Telemetry support.
- Direct EOC real-time command activities.
- Verify correctness of all EOC real-time activities.
- Support parallel S/C supports and ground system tests.

EOC Operations On-Line

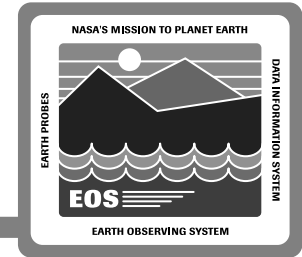


Command Control

The “Command Controller” will use the Command, Telemetry, and Resource Management subsystems to:

- Transmit commands and loads to designated EOC S/C.
- Verify reception and execution of commands.
- Verify acquisition and proper display of S/C telemetry.
- Support post real-time data playback.
- Support parallel S/C supports and ground system tests.

EOC Operations On-Line

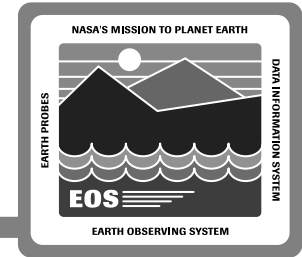


Operations Scheduling

The “Scheduler” uses the Planning, Scheduling, and Command Management subsystems to:

- Accept activity requests from PI/TL and Subsystem engineers.
- Formulate S/C and Inst. resource schedules.
- Request and verify TDRSS services.
- Compile S/C and Inst. command loads.

EOC Operations On-Line

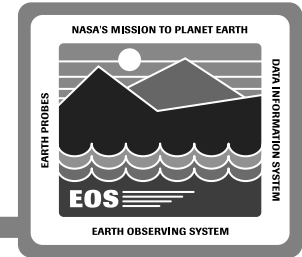


Telemetry Monitoring

The “S/C and Inst. Evaluators” use the Telemetry, Analysis, and Command Management subsystems to:

- Monitor EOC S/C and Inst. telemetry for anomalies and limit violations.
- Provide S/C and Inst. technical advice to the Operations Controller(PI/TL) in support of any observed anomalies.
- Execute routine and non-routine telemetry plot requests.
- Request execution of anomaly notification and anomaly command procedures.
- Build command loads for anomaly support.

EOC Operations On-Line

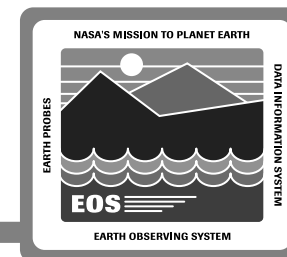


Ground Control

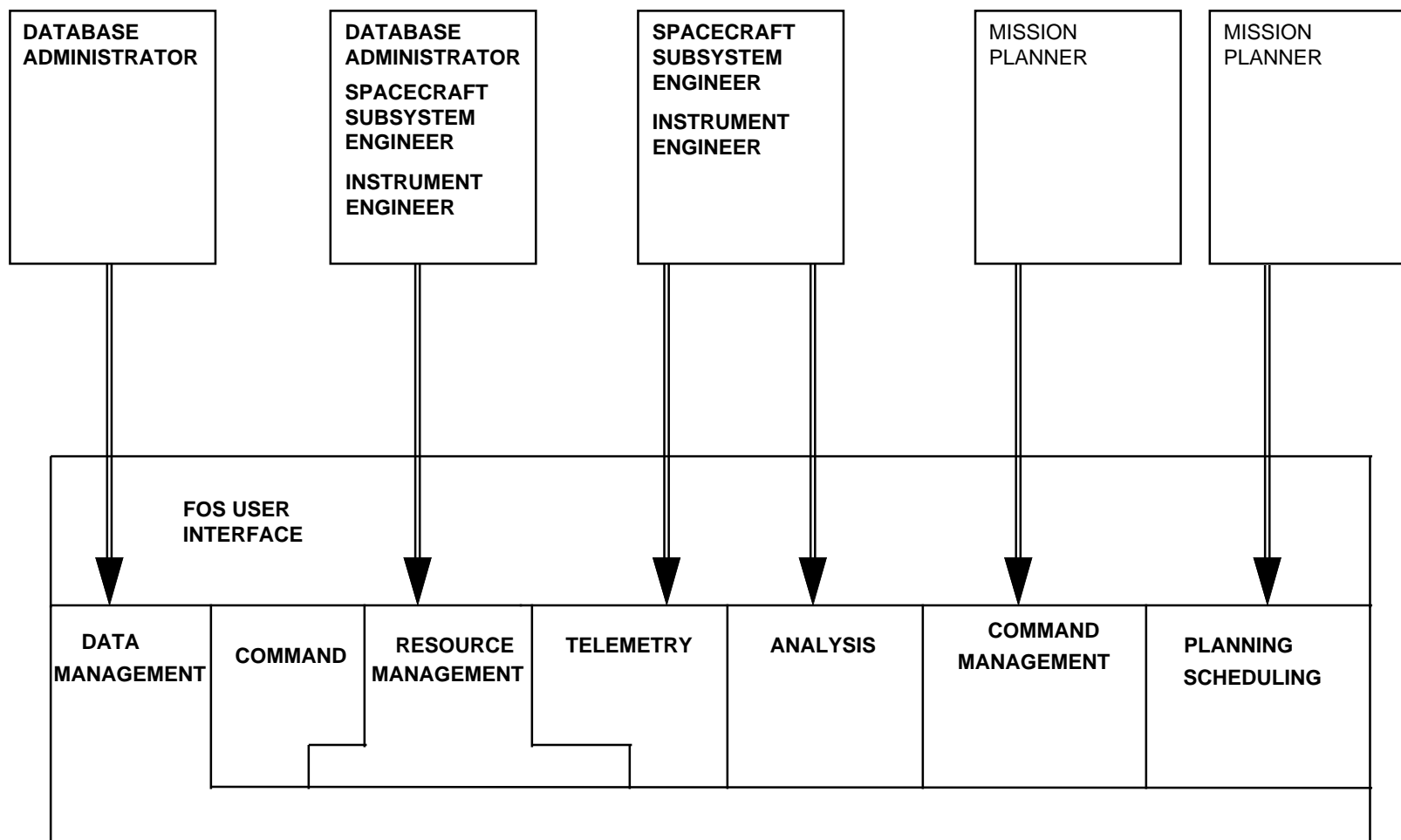
The “Ground Controller” will use the Resource Management subsystem to:

- Support proper operation and configuration of EOC systems.
- Verify proper reception and processing of EOS S/C data.
- Support proper operation of EOC-to-external interfaces: IST, ICC, EDOS, ECOM, NCC, DAAC.

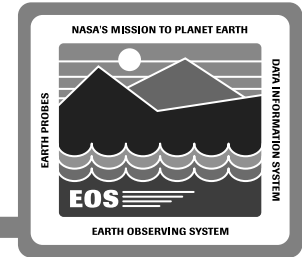
EOC Staff Off-Line



EOC STAFF



EOC Operations Off-Line

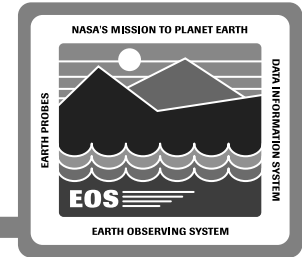


Mission Planning

The “Mission Planner” will use the Planning, Scheduling, and Command Management subsystems to:

- Support development of Baseline Activity Profiles and Activity Definitions with the PI/TL and the Subsystem Engineers.
- Plan the implementation of deviations to Baseline Activity Profiles and mediate the impacts.

EOC Operations Off-Line

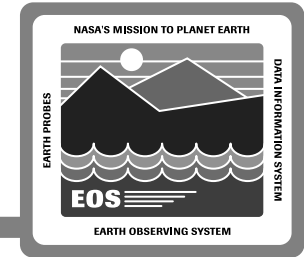


Off-line Analysis

The “Subsystem and Inst. Engineers” will use the Telemetry, Analysis, and Command Management subsystems to:

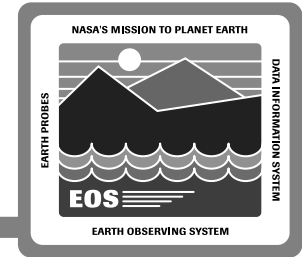
- Perform routine and non-routine telemetry analysis.
- Perform subsystem performance trending.
- Create command loads to effect desired spacecraft modes of operation.

EOC, Science and System Monitoring Operations Off-Line



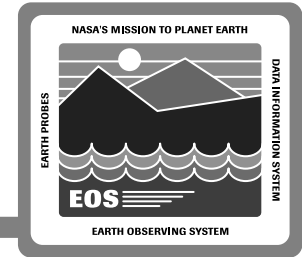
- **Data Base Maintenance**
 - **“Data Base Maintenance”** personnel will be responsible for maintaining the system data bases in Science, Flight, and System Monitoring
 - Maintainer will utilize many of the tools provided in the systems to analyze, maintain and distribute the data bases
 - Maintainer will work closely with the other operational personnel at all sites to insure that the data bases are correct and operationally efficient
 - Provide operations interface to perform data base administration utilities, such as data base backup and recovery
 - Performance monitoring and tuning
 - Administration of data base user access control, and daily data base synchronization

EOC, Science and System Monitoring Operations Off-Line



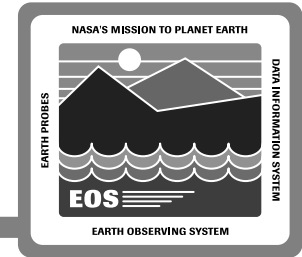
- **Software maintenance (COTS and developed)**
 - **“Software Maintenance”** personnel responsible for producing, delivering, testing and documenting the corrections, modifications, and enhancements made to ECS software, and/or to adapt or incorporate any COTS software for ECS use
- **Hardware maintenance**
 - **“Maintenance Administrator”** provides first-level maintenance, at each ECS site
 - Support the ECS availability requirements by replacement of line replaceable units (LRUs)
 - Act as coordination point with the various vendors including preventative maintenance support
 - Support isolation of equipment problems

EOC, Science and System Monitoring Operations Off-Line



- **Sustaining Engineering**
 - **“Sustaining Engineers” and “Performance Analysts” working with the ops personnel and users are responsible for:**
 - Analysis and identification of ways to accommodate needed improvements, new technologies and new concepts**
 - Manage system upgrades and evolution**
 - Control and maintain ECS updates, and perform the activities necessary to assure ECS reliability, maintainability, and availability**
 - Work with TAG to evaluate user inputs and monitor system performance to tune the system for optimum response and support**
 - Analyze soft and hardcopy reports on system effectiveness, productivity, capacity, and performance for all hardware and software resources and processes**
 - Monitor performance for trends and prepare reports of analysis**

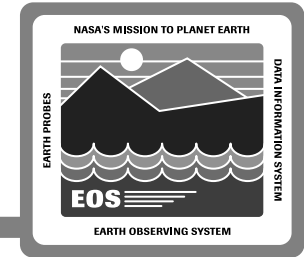
EOC, Science and System Monitoring Operations Off-Line



- **Configuration Management**

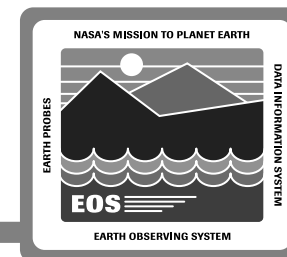
- **“Configuration Management” personnel provide the control and dissemination of the operational baseline for hardware and software with appropriate documentation**
- **The management subsystem of CSMS is one of the tools that the CM personnel utilize to control the baseline**
- **All versions of system, operational, and algorithm software must be maintained to ensure data integrity, system operability, traceability, and ability to fall back to a previous version**
- **Baseline merging at the sites is performed by CM to ensure that each site has baseline software plus any site specific extensions**
- **CM supports all testing by providing the proper software version to load on to the test string and captures all test results**

EOC, Science and System Monitoring Operations Off-Line

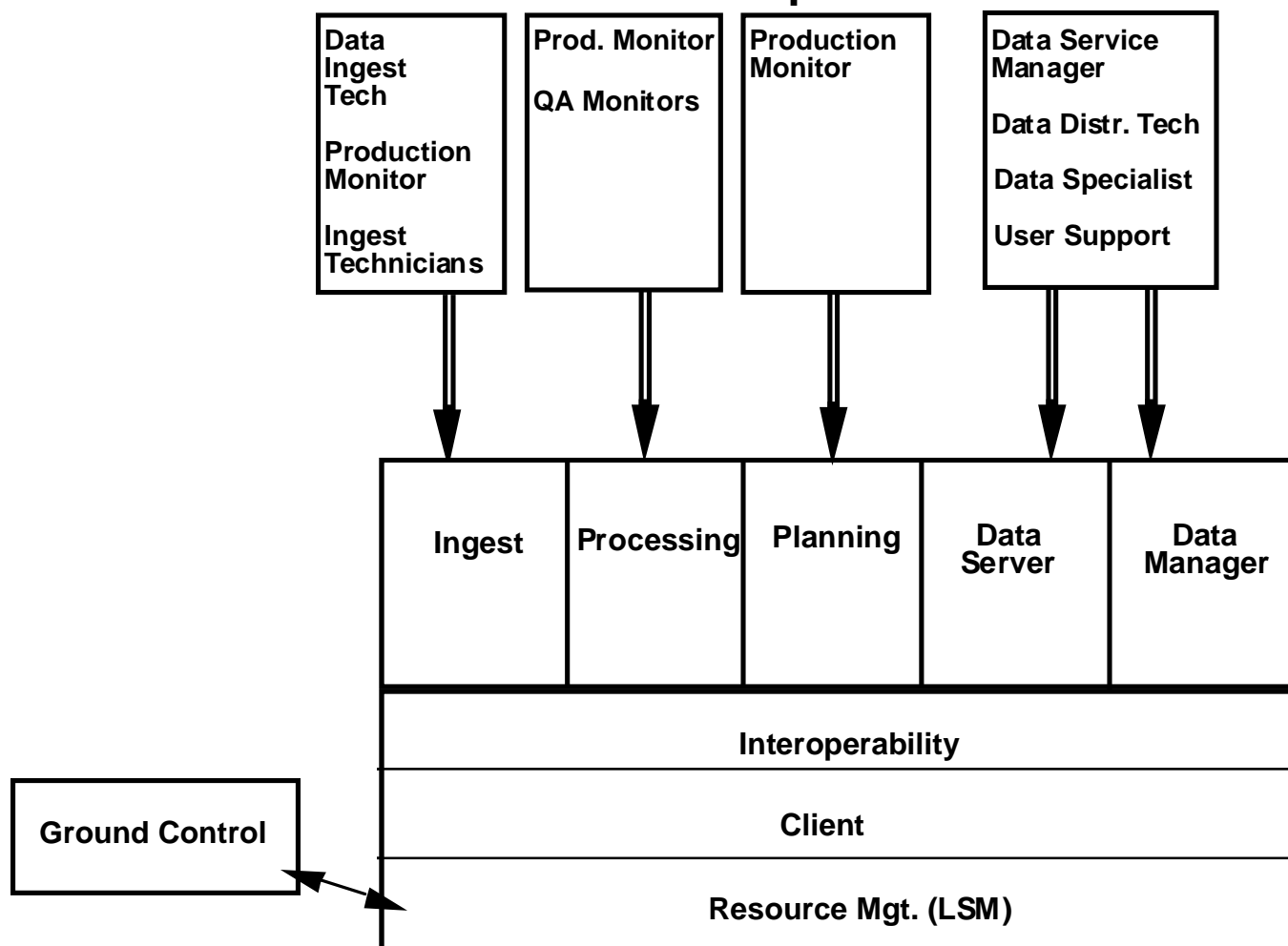


- **Operational Readiness and Performance Assurance**
 - **“Ops Readiness and Performance Assurance”** personnel provide maintenance of Operational Readiness Plan
 - Responsible for ensuring elements are in a state of operational readiness at all times including launch preparations
 - Responsible for regular monitoring of M&O activities, providing visibility to management
 - Provide coverage of operational phase activities in PAIP
 - Continue the tasks of the RMA program throughout the operational phase
- **Computer Operations**
 - **“Computer Operator”** operates the host processor, support restarts/reboots, monitor system status, responds to console messages, and does initial program loads for all system upgrades.
 - Perform minor housekeeping maintenance, operator level preventive maintenance and problem diagnosis and recovery

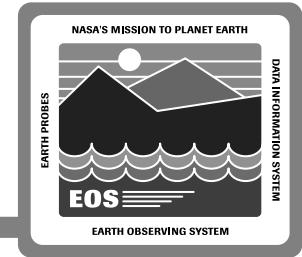
Science Operations Staff On-Line



Science Ops Staff



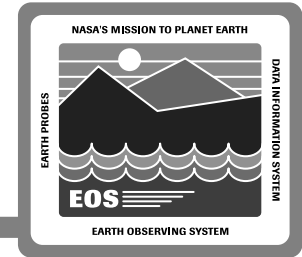
Science Operations On-Line



Data Ingest

- Ingest subsystem basically automatic relative to level 0 data and inter-DAAC data transfer
- Ingest client monitored by “Production Monitor” will respond to alarms, anomalies and support activation and deactivation
- Manual ingest handled by “Ingest Technicians” aided by Ingest Client
 - Unpack media
 - Log into system
 - Load and unload media from reader

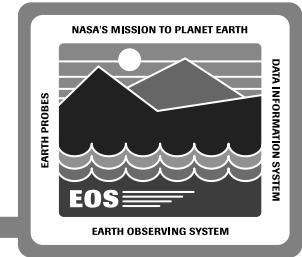
Science Operations On-Line



Processing

- Basically an automatic process with human acting as monitor and QA evaluator
- “Production/QA Monitor” use services of Processing and planning subsystems to
 - Initialize system
 - Monitor processing
 - Changing queue when required
 - Stopping system
- Product QA is part of algorithm and can be performed by “Production/QA Monitor” or at SCF
 - Inline QA would be performed by “Product/QA Monitor”
 - Off-line QA also performed by “Product/QA Monitor”

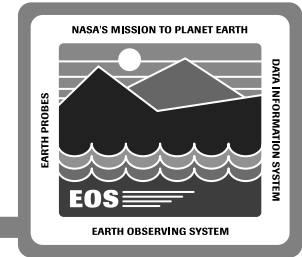
Science Operations On-Line



Data Storage and Distribution

- The data server subsystem automatically supports the data management and storage of data for both the archive and working storage
- The “Data Server Manager” will be monitoring the storage devices, storage drivers and storage media with output from the subsystem
- The Data Server Subsystem will support the distribution of data both electronically and via media
- The electronic distribution of data is handled automatically with the “Data Server Manager” monitoring the process
- Media distribution requires human interaction and is performed by the “Data Distribution Technicians”
 - Load and unload media from writer
 - Attach media labels and shipping labels generated by system
 - Perform shipping process

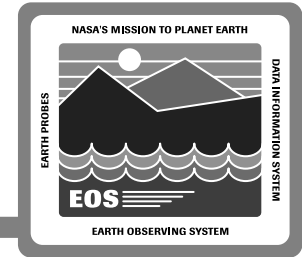
Science Operations On-Line



Information Access

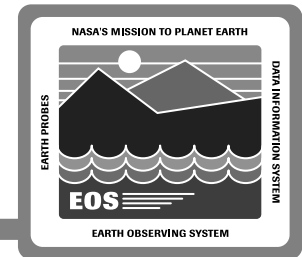
- **“Data Specialist”** and **“User Support”** will utilize the Data Manager subsystem to aid the user in finding data, interpreting data and ordering data

Science Operations On-Line

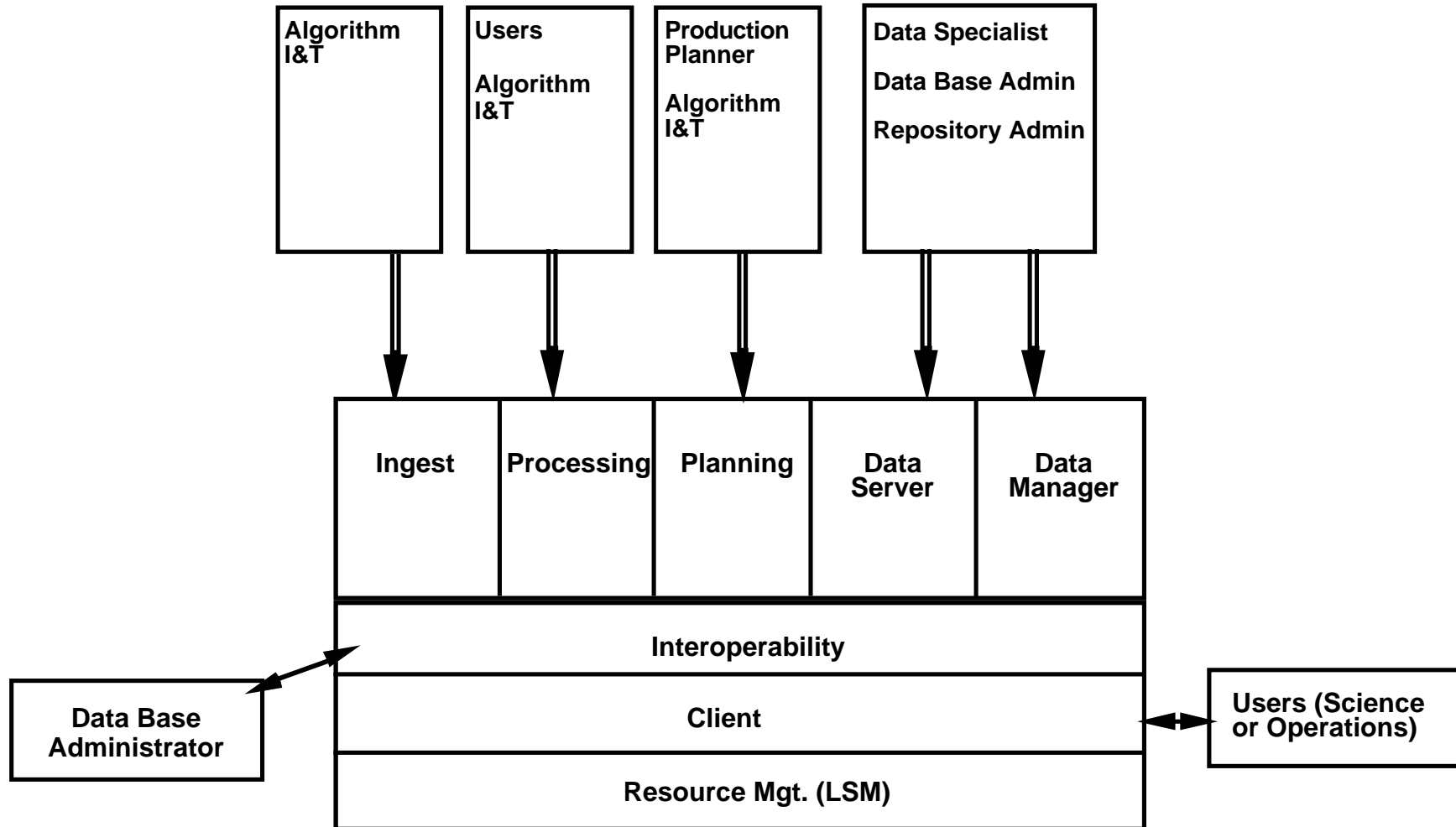


- The “Ground Controller” using the Management subsystem
 - Maintains and controls local operational configuration of ground and software resources
 - Monitors the status of the ground resources at the local DAAC level
 - Interacts with the DAAC staff to resolve local ground resource problems
 - Interacts with System Monitoring to resolve WAN connectivity problems
 - Responds to user requests for account status information
 - Generates system analysis reports;
 -

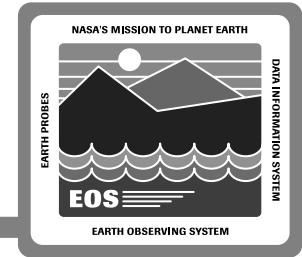
Science Operations Staff Off-Line



Science Ops Staff



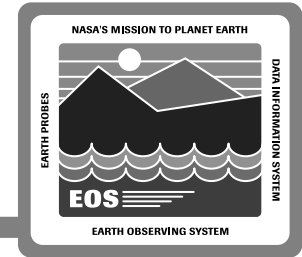
Science Operations Off-Line



Algorithm I&T

- **Algorithm I&T** “support personnel will reside at the DAACs to support the algorithm developers in integrating their algorithms into the DAAC ECS system
 - Support the use of toolkits
 - Support the use of CM process
 - Establish algorithm management data to allow inclusion in planning process
 - Aid in coordination with DAAC
 - Support testing of algorithms
 - Provide ECS system understanding
 - The Ingest, Processing and Planning subsystems will be utilized in running algorithms at the DAAC on a backup string

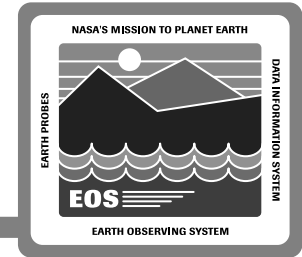
Science Operations Off-Line



Production Planning & Management

- The “Production Planner” uses the Planning Subsystem
 - Use data objects to configure and setup subsystem
 - Create candidate plans for now and future
 - Activate the processing plan
 - Change the processing plan
- Once a plan has been activated the data processing system interfaces automatically with processing plan

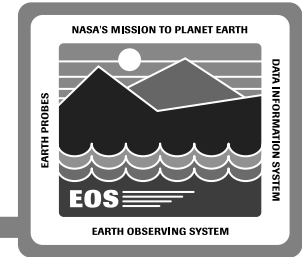
Science Operations Off-Line



Data Server Maintenance

- Most of the human functions handled in an off-line mode by “Data Specialist” and “Data Base Administrator”
 - Data Server Creation (an SCF could create a data server)
 - Monitor Data server (science users can monitor)
 - Maintain Data Server (an SCF can maintain)
 - Discontinue Data Server (originator can discontinue)
 - Generate Data Server Reports (originator can generate)
- Based upon direction from the “Data Server Manager” the “Repository Administrator” will maintain the storage system supported by output from the subsystem
- The “Repository Administrator” performs the following function
 - Periodic preventative maintenance
 - Periodic archive backup support (loading and unloading media)
 - Perform media sampling and refresh (analysis and media handling)

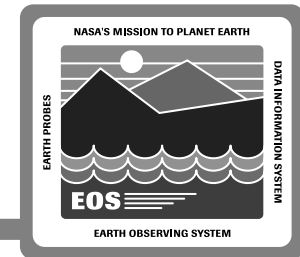
Science Operations Off-Line



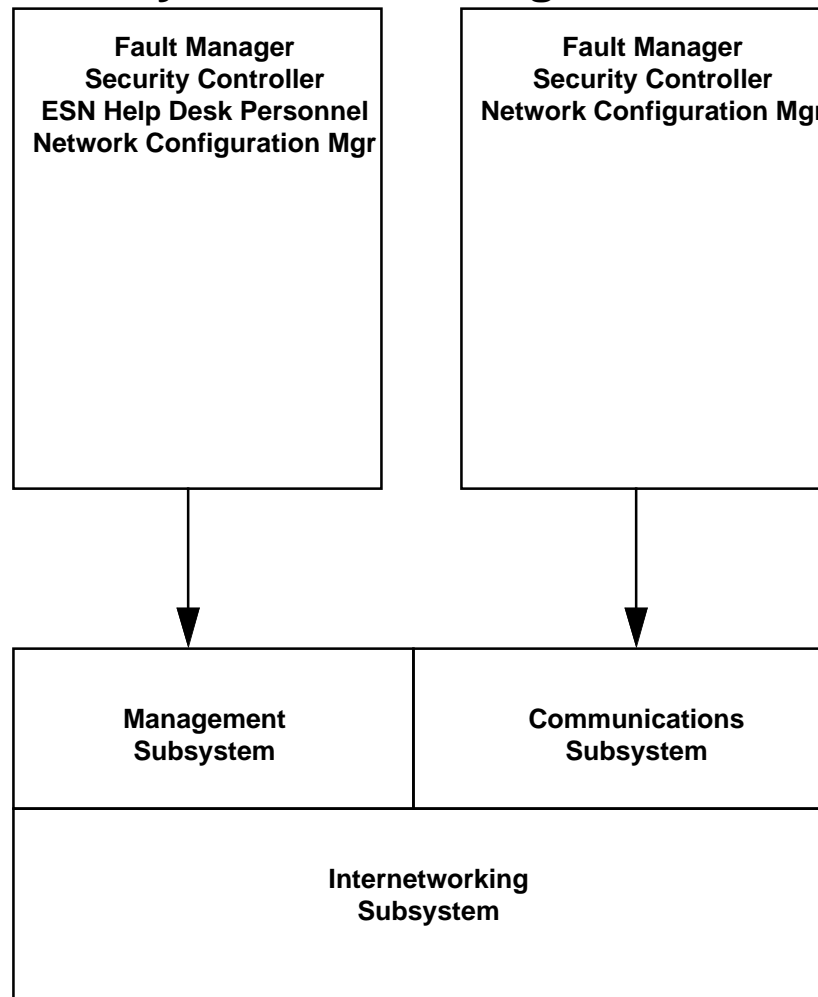
Schema / Data Dictionary Management

- Management and maintenance of Schema and Data Dictionary is done thru the Data Server and Data Management subsystems
 - Creation of DIM, LIM or data dictionary will be collaboration between science users and “Data Specialist” working with the “Data Base Administrator”
 - The “Data Specialist” will use the subsystem to monitor access history, gauge system performance and utilization, and perform trending on access patterns
 - The “Data Base Administrator” will use the subsystem to provide integrity checks and perform backups
 - Reconfiguration of the DIM and LIM will be done by the “Data Specialist” thru the subsystem

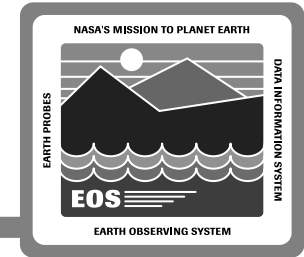
System Monitoring Staff On-Line



System Monitoring Staff

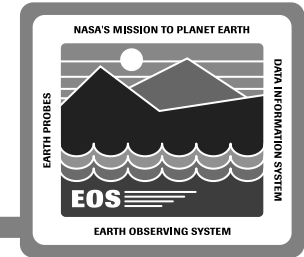


System Monitoring On-Line



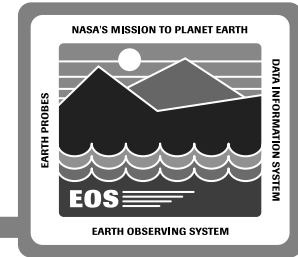
- **System Fault Management**
 - **“Fault Manager”** Interfaces with DAAC operations personnel to support resolution of inter-ECS site problems
 - **Performs fault diagnoses and fault analyses with the aid of the Fault Resolution Application Service (System Management)**
- **System Security Monitoring**
 - **“Security Controller”** Employs the Security Application Service in the Management Subsystem to monitor system level operational security, to include:
 - Authentication**
 - Compliance Management**
 - Security compromise detection, mitigation and resolution**

System Monitoring On-Line

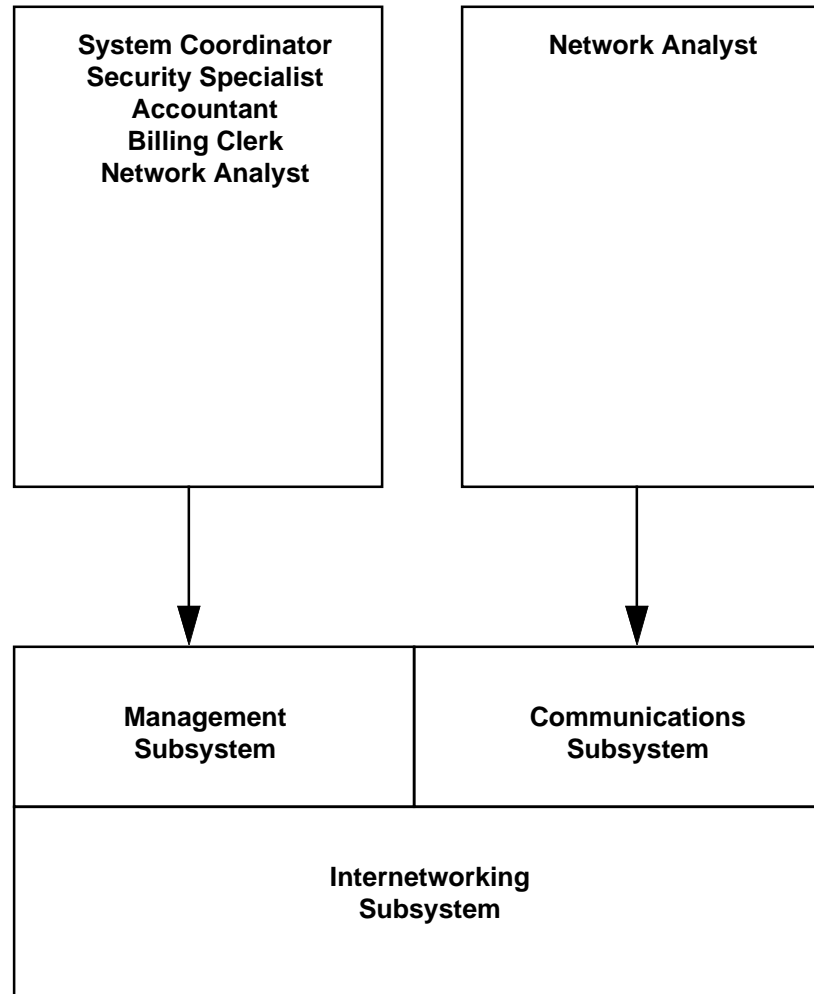


- **System Connectivity User Support**
 - **“ESN Help Desk Personnel”** Respond to requests for assistance from users and provides feedback
 - Utilizes the Communication Subsystem to assist users in resolving system problems
- **WAN Configuration Monitoring**
 - **“Network Configuration Manager”** Interacts with the Communication and Management Subsystems to monitor the system-wide network configuration
 - Assists SMC and DAAC personnel in network fault, performance and security management
 - Interfaces with external service provider organizations for fault resolution

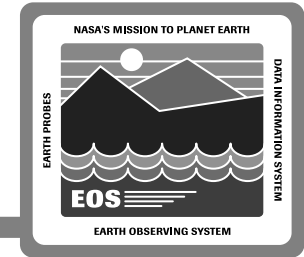
System Monitoring Staff Off-Line



System Monitoring Staff

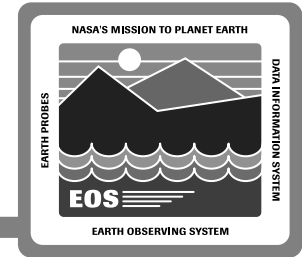


System Monitoring Off-Line



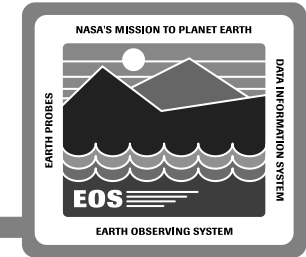
- **Ground System Coordination**
 - **“System Coordinator”** Utilizes the Resource Scheduling Application Service of the Management Subsystem to maintain high-level ground event schedule for all ECS elements
 - Communicates with each DAAC to coordinate product generation dependencies using the Management Subsystem
 - Monitors all schedules produced by each DAAC to ensure compatibility
- **System Security Evaluation**
 - **“Security Specialist”** Uses the Security Application Service in the Management Subsystem to establish, update and maintain the system security database
 - Evaluates system problems and recommends solutions
 - Works closely with operations and users to establish flexible but safe security procedures

System Monitoring Off-Line



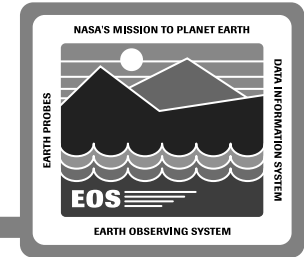
- **System Configuration Baseline Maintenance**
 - **“Configuration Manager”** Maintains the ECS configuration baseline and documentation library using the Configuration Application Service of the Management Subsystem
 - Coordinates system-level upgrades with sustaining engineering personnel at the DAACs
 - Works with DAAC configuration managers to adjust baselines as required
- **System Analysis**
 - **“Performance Analyst”** Utilizes the Performance Application Service of the Management Subsystem to monitor the status of system resources and to analyze trends in performance
 - Generates and updates performance criteria

System Monitoring Off-Line



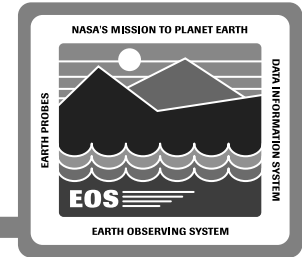
- **Network Analysis**
 - **“Network Analyst”** Employs the Communication and Management Subsystems to provide overall network engineering support to include fault, security and configuration support of both network hardware and software
 - **Assists SMC personnel in network fault, performance and security management**

System Monitoring Off-Line



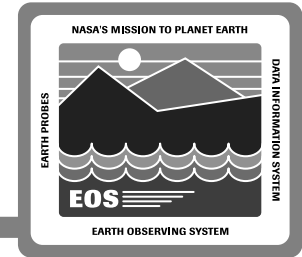
- **Accounting and Billing**
 - **“Accountant”** Maintains the policy management database of the Accounting and Accountability Application Service of the Management Subsystem
 - Utilizes the Audit Trail application to verify the accuracy and integrity of the system
 - **“Billing Clerk”** Interacts with the Accounting Management Application to maintain accounts payable and accounts receivable
 - Employs the Invoicing and Billing Application to report account status to users and notification of payment requirements (if any)
 - Performs the physical process of mailing bills or account status information

System Administration



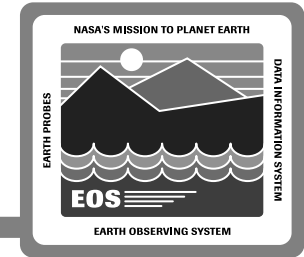
- **Logistics**
 - **“Logistics Support” personnel perform supply management at all ECS sites including requisitioning/purchasing, receiving, stocking, and distributing supplies and replenishment spares, inventory management of the same**
 - **System level spares and supply management of all ECS sites, including requisitioning of spares and supplies requested by remote sites**
 - **Coordination with GSFC Logistics Support Services for logistics support of ECS**
 - **Maintenance of documentation library required for identifying spare parts related to ECS HW and SW being supported**
 - **Receive and distribute ECS SW upgrades when received**

System Administration



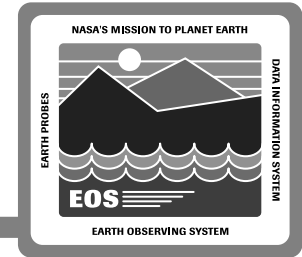
- **Personnel Administration**
- **Maintain Site Libraries**
- **Training**
 - **“Trainers”** maintain and update all training material used to orient new ops personnel, test for certification, support training process, and train the **“site trainers in the use of the training material”**
- **Quality Assurance**
 - **“Quality Assurance”** personnel perform QA audits on a periodic basis to ensure adherence to established standards and procedures for hardware, software and operations
 - **Produce audit reports semi-annually**
 - **Work with performance assurance personnel to track CMI program**
 - **Instill into operations importance of quality products and services**

System Administration



- **Property Management**
 - **“Property Management” personnel provide control of Contractor procured Government property and provide for continuous audit trail from receipt of item until transfer of accountability**
 - **Property management responsibility for ECS equipment until accepted by CO/COTR and equipment for which the contractor has M&O responsibility**
 - **Perform shipping and receiving functions**

Summary



- **Architecture subsystems traced to operational staff and functions**
- **Initial evaluation finds good fit between new architecture and baseline staff and functions**
Some minor reallocation of responsibilities
- **Ready to proceed to PDR**